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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,693	10/29/2003	Michael Shur	SETI-0007	5258

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EXAMINER	
DICKEY, THOMAS L	

ART UNIT	PAPER NUMBER
2826	

NOTIFICATION DATE	DELIVERY MODE
09/12/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTOCommunications@hwdpatents.com

Office Action Summary	Application No.	Applicant(s)
	10/696,693	SHUR ET AL.
	Examiner	Art Unit
	Thomas L. Dickey	2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 August 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,7,8,10,11,13-17,20,21,23-26,28 and 29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *23* is/are allowed.

6)☒ Claim(s) *1-3,7,8,10,11,13-17,20,21,24-26,28 and 29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/22/2008 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

A. Claims 1-3, 7, 8, 10, 13-17, 20, 24-26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over RYZHII ET AL., "Terahertz photomixing in quantum well structures" J. App. Phys. Vol. 91 p. 1875 (2002) in view of SARUKURA ET AL.,

"Submilliwatt, short-pulse, terahertz radiation from femtosecond-laser irradiated InAs in a magnetic field", Lasers and Electro-Optics, 1998. In the examiner's opinion, this/these claim(s) would have been obvious according to one of the rationales expressed in the *Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in KSR International Co. v. Teleflex Inc.*, as published at 72 Federal Register 57526 et seq.[1] (10/10/2007).

The Guidelines explain that an invention that would have been obvious to a person of ordinary skill at the time of the invention is not patentable. The Guidelines point out that, as reiterated by the Supreme Court in KSR, the framework for the objective analysis for determining obviousness under 35 U.S.C. 103 is stated in *Graham v. John Deere Co.* Obviousness is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court are as follows:

(1) Determining the scope and content of the prior art;
(2) Ascertaining the differences between the claimed invention and the prior art, and
(3) Resolving the level of ordinary skill in the pertinent art.

Examining this last factor first, it is noted that any obviousness rejection should include, either explicitly or implicitly in view of the prior art applied, an indication of the level of ordinary skill. This is an essential finding because (as the Guidelines point out) a

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[1] Available at http://www.uspto.gov/web/offices/com/sol/notices/72fr57526.pdf

finding as to the level of ordinary skill may be used as a partial basis for a resolution of the issue of obviousness. The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. Factors that may be considered in determining the level of ordinary skill in the art include:

(1) "Type of problems encountered in the art;"
(2) "prior art solutions to those problems;"
(3) "rapidity with which innovations are made;"
(4) "sophistication of the technology;" and
(5) "educational level of active workers in the field."

In a given case, every factor may not be present, and one or more factors may predominate. In the present case, Applicant has presented claims to a device classified in Class 257 (Semiconductor Devices). Evaluating the level of skill with reference to the five factors, the Examiner finds:

(1) The types of problems encountered in Class 257 typically are highly complex, involving questions of electrodynamics, thermodynamics, crystallography, and quantum mechanics.

(2) Prior art solutions to problems presented in this field demonstrate thinking of the highest order. Many prior art solutions in this field have won Nobel prizes. Past Nobel prizewinners for Class 257 innovations include John Bardeen, William Schockley, Jack

Kilby, Leo Esaki, Nick Basow, Zhores Alferov, Pierre-Gilles de Gennes, and probably a half dozen[2] more this writer has forgotten.

The Nobel Prize committee is not, of course, the only organization recognizing valuable prior art solutions to class 257 problems. For example, in 2003 the magazine Compound SemiNews recognized Shuji Nakamura, Michael Shur, Norm Schumaker, John Edmond, and Bob Steele for their extremely valuable ("valuable", as defined by Compound SemiNews, means potential financial value in the billions of dollars) semiconductor solutions in the III-nitride blue LED field. In "Pioneering the Blue Spectrum," editor Jo Ann McDonald explained, "Blue spectrum solid state light emitting diodes (LEDs) and laser diodes (LDs) made of Group III nitride materials, are revolutionizing the world of lighting and optical storage. The history of their evolution is the classic '20 year overnight success' story. The visionaries who pioneered the commercial applications kept chipping away and, finally, in 2003 the blue spectrum industry is tapping the Mother Lode." See http://www.compoundsemi.com/news/pdf/blue2003pioneers.pdf.

[2] On reflection, this writer can only recall five more Nobel Prizes awarded to individuals in recognition of their providing valuable prior art solutions to problems in the semiconductor arts: Herbert Kroemer, winner of the 2000 Nobel prize recognizing the heterojunction semiconductor laser as a valuable prior art solution, Albert Fert and Peter Grünberg, recognized for Giant Magnetoresistance (valuable in the field of semiconductor memories), Walter Houser Brattain, recognized for a prior art solution, known as the "transistor effect," which has proven to be of some small value to humankind; and Klaus von Klitzing, discoverer of the quantum Hall effect. So it turns out this writer had only forgotten the valuable prior art semiconductor solutions made by five Nobel Prize winners, not half a dozen.

Other evidence of valuable prior art solutions in the semiconductor art may be found in a 2002 press release from Sensor Electronic Technology, Inc. (SET). In this release, SET explains, "The development of semiconductor-based UV light sources is of critical importance to the military. Miniaturized UV light sources have application in biological agent detection, nonline-of-sight (NLOS) covert communications, water purification, equipment/personnel decontamination, and white light generation." SET explains, further, that the Defense Advanced Research Projects Agency (DARPA) "is interested in exploiting 'the unique characteristics of wide bandgap semiconductors to produce optical sources operating in the ultraviolet portion of the spectrum that can be integrated into modules and subsystems to address these applications.'" The SET press release provides more evidence of the highly useful nature of prior art solutions in the semiconductor arts, as well as of the value assigned to such prior art solutions by grant-making agencies such as DARPA. See http://compoundsemiconductor.net/cws/article/news/16457.

Note also that recently, while examining the last two decades of progress in the semiconductor art, the New York Times commented, "If innovation has a heart, it's probably a semiconductor, beating to the pace of Moore's Law." See "Trying to Put New Zip Into Moore's Law"[3]

[3] New York Times, 2/28/08 (http://www.nytimes.com/2008/02/24/business/24proto.html?_r=1&th)

(3) Innovations in Class 257 are made extremely rapidly (see, e.g. “Moore’s Law”).

(4) Technology used to make and practice inventions in this field are highly sophisticated. Some “fabs” (as those of skill in the art call the factories for making these devices) now cost in excess of three billion dollars <u>each</u>, and perform literally hundreds of billions of operations per hour.

(5) Finally, the educational level of active workers in this field is extremely high – Ph.D.s are common, and a bachelor’s degree in engineering is the absolute minimum educational level of workers in this field.

In short, the level of ordinary skill in this field is extremely high. In *KSR* (while considering an invention involving the substitution of one simple mechanical linkage for another), the Supreme Court cautioned, “A person of ordinary skill is also a person of ordinary creativity”. *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Had the Court been looking at the variety of extraordinarily valuable (from lifestyle-changing, such as high-speed communications and computing, to handy devices such as IPods and cellphones) and difficult solutions to challenging problems that have been accomplished in the semiconductor art in recent years, the Court might easily have said that in the semiconductor art the person of ordinary skill is a person of <u>extraordinary</u> creativity.

Next, we consider the first and second factual findings required by *Graham*. With regard to claims 1-3, 7, and 24, the scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of managing terahertz radiation, the method comprising: providing a semiconducting device having a two-dimensional carrier gas (in the QW channel, as Ryzhii et al. explicitly discloses at the second column of page 1881) and comprising (note figure 1) a field effect transistor; exciting the carrier gas by shining a laser having an energy higher than 1.42 eV (the energy required to achieve a transition from bound states to continuum states, note the left column of page 1876) directly onto a bottom side of the semiconducting device; and adjusting a frequency of the radiation to a desired frequency using a gate bias voltage (the top of the right column of page 1876 states, “Due to the dependence of Σ on the bias voltages, the plasma resonances are voltage tunable”) applied to the semiconducting device. Note figure 1 and pages 1875-1876 and 1881 of Ryzhii et al. The difference between the prior art method disclosed by Ryzhii et al. and the method of claims 1-3, 7, and 24 is that, where claims 1-3, 7, and 24 require a step of generating a 1-10,000 femtosecond laser pulse with a laser, Ryzhii et al.’s method includes a step of shining two lasers with a difference frequency.

With regard to claim 8 the scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of generating radiation using a field effect transistor, the method comprising: shining a laser directly onto a gate (indicated in figure 1(b) as "Gate") of the field effect transistor; and adjusting a frequency of the radiation to a desired frequency by adjusting a gate length for the gate (note the bottom of the left column of page 1876, stating, "The resonant plasma frequencies are determined by the length of the QW channel (2*L*)") to adjust a carrier density of carriers in a channel of the field effect transistor. Note figure 1 and pages 1875-1876 of Ryzhii et al. The difference between the prior art method disclosed by Ryzhii et al. and the method of claim 8 is that, where claim 8 requires a step of generating a laser pulse with a laser, Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency.

With regard to claims 10 and 13 the scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of generating terahertz radiation comprising the steps of shining a laser directly onto a transparent gate (indicated in figure 1(b) as "Gate") of a field effect transistor; and adjusting a frequency of the radiation (note the bottom of the left column of page 1876 ["The resonant plasma frequencies are determined by the length of the QW channel (2*L*) and the electron sheet concentration in it (Σ)"] and the top of the right column ["Due to the dependence of Σ on the bias volt-

ages, the plasma resonances are voltage tunable"]) to a desired frequency by adjusting a carrier density of carriers (note, again, that Ryzhii et al. teaches changing the sheet carrier density (Σ) by adjusting the bias voltages) in a channel of the field effect transistor. Note figure 1 and pages 1875-1876 of Ryzhii et al. The difference between the prior art method disclosed by Ryzhii et al. and the method of claims 10 and 13 is that, where claims 10 and 13 require a step of generating a laser pulse with a laser, Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency.

With regard to claims 14 and 29 the scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of generating radiation comprising shining a laser pulse directly onto a gate of a field effect transistor; and adjusting a frequency of the radiation to a desired frequency by adjusting a carrier density of carriers in a channel of the field effect transistor, wherein the shining excites plasma oscillations and wherein an active layer in the field effect transistor traps the plasma oscillations as plasma waves. The difference between the prior art method disclosed by Ryzhii et al. and the method of claims 1-3 and 7 is that, where claims 14 and 29 require a step of generating a 1-10,000 femtosecond laser pulse with a laser, Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency.

With regard to claims 15-17, 20, 25, and 26 the scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of generating terahertz radiation using a heterodimensional diode comprising the steps of shining a laser directly onto a bottom side of a substrate of a heterodimensional diode including an ohmic contact (side contacts shown in figures 1(a) and 1(b) and described in the left column of page 1876) and a rectifying contact (the Schottky collector described in the left column of page 1876); and adjusting a frequency of the radiation to a desired frequency using a voltage applied (the top of the right column of page 1876 states, “Due to the dependence of Σ on the bias voltages, the plasma resonances are voltage tunable”) to the heterodimensional diode to adjust a frequency of a plasma wave in a two-dimensional carrier gas in the heterodimensional diode. Note figure 1 and pages 1875-1876 and 1881 of Ryzhii et al. The difference between the prior art method disclosed by Ryzhii et al. and the method of claims 15-17, 20, 25, and 26 is that, where claims 15-17, 20, 25, and 26 require a step of generating a 1-10,000 femtosecond laser pulse with a laser (as well as a second such pulse), Ryzhii et al.’s method includes a step of shining two lasers with a difference frequency.

The difference between the prior art method disclosed by Ryzhii et al. and the method of any of claims 1-3, 7, 8, 10, 13-17, 20, 24-26, and 29 is therefor that, where

these claims require a step of generating a 1-10,000 femtosecond laser pulse with a laser (and including multiple pulses in claims 15-17, 20, 25, and 26), Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency. Ryzhii et al. does teach (note the first column of page 1875) that optical techniques using a coherent output at the difference frequency equal to the difference between the frequencies of radiation emitted by two lasers (as Ryzhii et al. does) or a response of photoconductive structures to femtosecond optical pulses (as is claimed) are, in Ryzhii et al.'s words, "Alternative approaches."

Sarukura et al. discloses a method of generating radiation including a step of generating a series of 70 femtosecond laser pulses with a laser and shining the laser pulses onto a III-V target. Sarukura et al.'s method produces a tunable THz source in the 0.5–3 THz region by shining a laser onto a III-V semiconductor target. Note figures 2A-2B and the second paragraph of Sarukura et al. The question is, taking into account the high level of education, skill, and creativity of one of ordinary skill in the semiconductor art, would it have been obvious to achieve the invention of claims 1-3, 7, 8, 10, 13, 14, and 29 by substituting the step of step of generating a series of 70 femtosecond laser pulses with a laser taught by Sarukura et al. for Ryzhii et al.'s step of shining two lasers with a difference frequency?

To reject a claim based on the basis of the rationale expressed in section IIIB of the *Examination Guidelines*, Office personnel first must resolve the Graham factual inquiries (as has just been done). Office personnel must then articulate the following:

> (1) a finding that the prior art contained a device (method, product, etc.) which differed from the claimed device by the substitution of some components (step, element, etc.) with other components;
>
> (2) a finding that the substituted steps and their functions were known in the art;
>
> (3) a finding that one of ordinary skill in the art could have substituted one known element for another, and the results of the substitution would have been predictable; and
>
> (4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

As explained above, Ryzhii et al. discloses a method that differed from the claimed device only by the substitution of some steps (a step of generating a series of 70 femtosecond laser pulses with a laser) for other steps (a step of shining two lasers with a difference frequency). Sarukura et al. discloses that the substituted steps and their functions were known in the art. Further, Sarukura et al. discloses that those of skill in the art were familiar with a method combining the step of generating a series of 70 femtosecond laser pulses with a laser with a method (producing a tunable THz source in the 0.5–3 THz region by shining a laser onto a III-V semiconductor target) very similar to Ryzhii et al.'s method. From the similarities between Sarukura et al.'s method and Ryzhii et al.'s method, one of skill in the art would have been able to conclude that the step of generating a series of 70 femtosecond laser pulses with a laser could have substi-

tuted for the step of shining two lasers with a difference frequency of Ryzhii et al.'s method. One of skill in the art would have had reason to predict (based on its functioning in combination with Sarukura et al.'s method) that the step of generating a series of 70 femtosecond laser pulses with a laser would have continued functioning much as it did in combination with Sarukura et al.'s method, and that after the substitution, Ryzhii et al.'s method would continue functioning in the manner disclosed by Ryzhii et al. It would therefore have been obvious to a person having skill in the art to modify Ryzhii et al.'s method by substituting the step of generating a series of 70 femtosecond laser pulses with a laser taught by Sarukura et al. for Ryzhii et al.'s step of shining two lasers with a difference frequency.

B. Claims 11, 21 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over RYZHII ET AL., "Terahertz photomixing in quantum well structures" J. App. Phys. Vol. 91 p. 1875 (2002), in view of SARUKURA ET AL., "Submilliwatt, short-pulse, terahertz radiation from femtosecond-laser irradiated InAs in a magnetic field", Lasers and Electro-Optics, 1998, and PERALTA ET AL., "Terahertz photoconductivity and plasmon modes in double-quantum-well field-effect transistors" Appl. Phys. Lett. Vol. 81 p. 1627 (2002) In the examiner's opinion, this/these claim(s) would have been obvious according to one of the rationales expressed in the *Examination Guidelines for Determining*

Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in KSR International Co. v. Teleflex Inc., as published at 72 Federal Register 57526 et seq. (10/10/2007).

The Guidelines explain that an invention that would have been obvious to a person of ordinary skill at the time of the invention is not patentable. The Guidelines point out that, as reiterated by the Supreme Court in KSR, the framework for the objective analysis for determining obviousness under 35 U.S.C. 103 is stated in *Graham v. John Deere Co.* Obviousness is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court are as follows:

(1) Determining the scope and content of the prior art;
(2) Ascertaining the differences between the claimed invention and the prior art, and
(3) Resolving the level of ordinary skill in the pertinent art.

With regard to claims 11, 21 and 28, we begin by considering the first and second factual findings (the third finding concerning the level of skill in the art, is the same as before) required by *Graham*. The scope and content of the prior art includes, in the Ryzhii et al. disclosure, a description of a method of managing terahertz radiation, the method comprising: providing a field effect transistor having a two-dimensional carrier gas and a transparent gate; exciting the carrier gas by shining a laser; and adjusting a frequency of the radiation to a desired frequency using a bias voltage applied to the transparent gate of the field effect transistor; wherein the bias voltage adjusts a carrier

density of carriers in a channel of the field effect transistor. Note figure 1 and pages 1875-1876 and 1881 of Ryzhii et al. The difference between the prior art method disclosed by Ryzhii et al. and the method of claims 11, 21, and 28 is that:

1) Where these claims require a step of generating a 1-10,000 femtosecond laser pulse with a laser, Ryzhii et al.'s method includes a step of shining two lasers with a difference frequency. Ryzhii et al. does teach (note the first column of page 1875) that optical techniques using a coherent output at the difference frequency equal to the difference between the frequencies of radiation emitted by two lasers (as Ryzhii et al. does) or a response of photoconductive structures to femtosecond optical pulses (as is claimed) are, in Ryzhii et al.'s words, "Alternative approaches."

2) Where the claim requires the use of a periodic grating gate, Ryzhii et al.'s method uses a transparent gate.

Sarukura et al. discloses a method of generating radiation including a step of generating a series of 70 femtosecond laser pulses with a laser and shining the laser pulses onto a III-V target. Sarukura et al.'s method produces a tunable THz source in the 0.5–3 THz region by shining a laser onto a III-V semiconductor target. Note figures 2A-2B and the second paragraph of Sarukura et al. Further, Peralta et al. discloses a method of producing voltage-tuned terahertz radiation with a grating-gated field-effect transistor.

Note figure 1, the abstract, and the left column of page 1627 of Peralta et al. The question is, taking into account the high level of education, skill, and creativity of one of ordinary skill in the semiconductor art, would it have been obvious to achieve the invention of claims 11, 21, and 28 by substituting the step of step of generating a 70 femtosecond laser pulse with a laser taught by Sarukura et al. for Ryzhii et al.'s step of shining two lasers with a difference frequency, and by substituting Peralta et al.'s periodic grating gate for Ryzhii et al.'s transparent gate?

To reject a claim based on the basis of the rationale expressed in section IIIB of the *Examination Guidelines*, Office personnel first must resolve the Graham factual inquiries (as has just been done). Office personnel must then articulate the following:

> (1) a finding that the prior art contained a device (method, product, etc.) which differed from the claimed device by the substitution of some components (step, element, etc.) with other components;
>
> (2) a finding that the substituted components and their functions were known in the art;
>
> (3) a finding that one of ordinary skill in the art could have substituted one known element for another, and the results of the substitution would have been predictable; and
>
> (4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

As explained above, Ryzhii et al. discloses a method that differed from the claimed device only by the substitution of some steps (a step of generating a 70 femtosecond laser pulse with a laser) for other steps (a step of shining two lasers with a difference frequency). Sarukura et al. discloses that the substituted steps and their functions were

known in the art. Further, Sarukura et al. discloses that those of skill in the art were familiar with a method combining the step of generating a 70 femtosecond laser pulse with a laser with a method (producing a tunable THz source in the 0.5–3 THz region by shining a laser onto a II-V target) very similar to Ryzhii et al.'s method. From the similarities between Sarukura et al.'s method and Ryzhii et al.'s method, one of skill in the art would have been able to conclude that the step of generating a 70 femtosecond laser pulse with a laser could have substituted for the step of shining two lasers with a difference frequency of Ryzhii et al.'s method. One of skill in the art would have had reason to predict (based on its functioning in combination with Sarukura et al.'s method) that the step of generating a 70 femtosecond laser pulse with a laser would have continued functioning much as it did in combination with Sarukura et al.'s method, and that after the substitution, Ryzhii et al.'s method would continue functioning in the manner disclosed by Ryzhii et al. It would therefore have been obvious to a person having skill in the art to modify Ryzhii et al.'s method by substituting the step of generating a 70 femtosecond laser pulse with a laser taught by Sarukura et al. for Ryzhii et al.'s step of shining two lasers with a difference frequency.

Further, Ryzhii et al. discloses a method of producing terahertz radiation with a voltage-tuned FET that differed from the FET used in the claimed method by the substitu-

tion of some components (a periodic grating gate) with other components (a transparent gate). Peralta et al. discloses that the substituted components and their functions were known in the art. Further, Peralta et al. discloses that those of skill in the art were familiar with a method of combining a periodic grating gate with a field-effect transistor similar to Ryzhii et al.'s field-effect transistor. From the similarities between Peralta et al.'s field-effect transistor and Ryzhii et al.'s field-effect transistor, one of skill in the art would have been able to conclude that the periodic grating gate could have substituted for the transparent gate of Ryzhii et al.'s field-effect transistor. One of skill in the art would have had reason to predict (based on its functioning in combination with Peralta et al.'s field-effect transistor) that the periodic grating gate would have continued functioning much as it did in combination with Peralta et al.'s field-effect transistor, and that when substituted, Ryzhii et al.'s field-effect transistor would continue functioning in the manner disclosed by Ryzhii et al. It would therefore have been obvious to a person having skill in the art to modify Ryzhii et al.'s method by substituting the periodic grating gate taught by Peralta et al. for Ryzhii et al.'s transparent gate.

C. The Guidelines point out that the both the Graham and KSR decisions require Office personnel to evaluate objective evidence relevant to the issue of obviousness. Such evidence, sometimes referred to as "secondary considerations," may include evidence

of commercial success, long-felt but unsolved needs, failure of others, and unexpected results. The evidence may be included in the specification as filed, accompany the application on filing, or be provided in a timely manner at some other point during the prosecution. The weight to be given any objective evidence is decided on a case-by-case basis. The mere fact that an applicant has presented evidence does not mean that the evidence is dispositive of the issue of obviousness.

For evidence of unexpected results one must rely solely on evidence supplied by Applicants. Applicants have actually made the claimed combination. Evidence of differences between results of the actual functioning of the claimed combination and the results of the functioning one of skill in the art would have had reason to predict (i.e., the "expected results") must necessarily come from one who has actually made the combination. A clear case of unexpected results would be if the claimed combination of prior art elements did not in fact perform according to their established functions in a predictable fashion; a result sometimes referred to as "synergy." See *Anderson's-Black Rock v. Pavement Co.* 396 U.S. 57, 61 (1969) (note that the *Anderson's-Black Rock* opinion does not actually employ the word "synergy"). However, the Guidelines make it clear that any type of unexpected results (and indeed any type of secondary considerations) must be considered.

Applicants' specification, however, does not include any evidence of secondary considerations. Applicants disclose that the claimed combination "may be" made; Applicants do not disclose any unexpected results or indeed any results at all.

Allowable Subject Matter

3. Claim 23 is allowable because it specifically requires a 20 femtosecond laser pulse, which is a much (1/3 or less) shorter pulse than the laser pulses used in the prior art to produce terahertz radiation from III-nitride targets.

Response to Arguments

4. Applicant's arguments with respect to claims 1-3, 7, 8, 10, 11, 13-17, 20, 21, 24-26, 28 and 29 have been considered but are moot in view of the new ground(s) of rejection.

Applicants argue at page 10 of the reply that "Applicants note that the presence of several Nobel laureates in a field, such as the semiconductor device industry, is largely irrelevant to a finding of the level of ordinary skill as provided by the MPEP and case law".

Applicant's arguments ignore the fundamental nature of the Nobel Prize, which is to recognize the solving of a particular problem in the physical sciences. For example, in 2000 the Nobel Prize committee released the following statement:

> Through their inventions this year's Nobel Laureates in physics have laid a stable foundation for modern information technology. **Zhores I. Alferov** and **Herbert Kroemer** have invented and developed fast opto- and microelectronic components based on layered semiconductor structures, termed semiconductor heterostructures. Fast transistors built using heterostructure technology are used in e.g. radio link satellites and the base stations of mobile telephones. Laser diodes built with the same technology drive the flow of information in the Internet's fibre-optical cables. They are also found in CD players, bar-code readers and laser pointers. With heterostructure technology powerful light-emitting diodes are being built for use in car brake-lights, traffic lights and other warning lights. Electric bulbs may in the future be replaced by light-emitting diodes.

http://nobelprize.org/nobel_prizes/physics/laureates/2000/press.html. Note that in their statement the Nobel Prize Committee focused solely on the practical value of a particular prior art semiconductor solution reached by the prizewinners. Note that the Nobel Prize Committee specifically referenced the inventions made by the 2000 Nobel Laureates. Note further that the Nobel Prize Committee explained, "Fast transistors built using heterostructure technology are used in e.g. ... the base stations of mobile telephones." Applicants seem to believe that Nobel Prize-winning technology is on a level too rarefied to be of use in evaluating the level of skill in their art. But when did Applicants (or any of us) last attend a public function without being disturbed by the raucous din of a cell-phone powered by a batch of Nobel Prize-winning "Fast transistors built using heterostructure technology?" The Nobel Prize Committee further explained,

"With heterostructure technology powerful light-emitting diodes are being built for use in car brake-lights, traffic lights and other warning lights." When did Applicants last stop at a traffic light that was not run by powerful light-emitting diodes made with Nobel Prize-winning heterostructure technology?

Evidence (such as that supplied in 2000 by the Nobel Prize committee) of prior art solutions to prior art problems in the semiconductor field is relevant to the first and second of five factors that should be used to make a finding regarding the level of skill in the semiconductor art. The five factors are[4]: (1) "Type of problems encountered in the art;" (2) "prior art solutions to those problems;" (3) "rapidity with which innovations are made;" (4) "sophistication of the technology;" and (5) "educational level of active workers in the field". *Examiner Guidelines*, 72 F.R. at 57528, quoting *In re GPAC*, 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995); *Custom Accessories, Inc.* v. *Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962, 1 USPQ2d 1196, 1201 (Fed. Cir. 1986); and

[4] in case Applicants missed the five factors when the Federal Circuit first laid them out in *Envtl. Designs, Ltd.* v. *Union Oil Co.*, 713 F.2d 693, 696, 218 USPQ 865, 868 (Fed. Cir. 1983), and in case Applicants missed them again when the Federal Circuit quoted *Envtl. Designs* in *Custom Accessories, Inc.* v. *Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962, 1 USPQ2d 1196, 1201 (Fed. Cir. 1986), and in case Applicants missed them a third time when the Federal Circuit quoted *Envtl. Designs* and *Custom Accessories* in *In re GPAC*, 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995). Applicants need not, of course have noticed these published cases, because this Office cited them (for Applicants' benefit) at page 57528 of volume 72 of the Federal Register; and this Examiner quoted the relevant passage of the F.R. in his last communication to Applicants.
It is noted that Applicants have (apparently without reading the case) "cite-bited" *Envtl. Designs* (the very case where the Federal Circuit first laid out the five factor test) in an attempt to convince the Examiner that the evidence regarding the type of problems encountered in the semiconductor art and the prior art solutions to those problems (the first two of the five factors laid out by *Envtl. Designs*) provided so copiously over the years by various Nobel Prize awards is somehow irrelevant to the level of skill in the semiconductor art.

Envtl. Designs, Ltd. v. *Union Oil Co.*, 713 F.2d 693, 696, 218 USPQ 865, 868 (Fed. Cir. 1983). Applicants stand mute on the Examiner's analysis of factors 3-5, so apparently Applicants agree with the Examiner's findings regarding those factors.

Applicants further argue, "Applicants respectfully submit that the Office's finding that the level of ordinary skill includes 'extraordinary creativity' and is 'unprecedented in the history of Man' extends well beyond the support provided by the Office and is unduly high. Since the Office applied an unduly high level of ordinary skill in analyzing the claimed inventions, Applicants respectfully request withdrawal of the obvious rejections." However, the Office is required to make findings regarding the level of skill in the art commensurate with the available documentary evidence.

It is commensurate with the available documentary evidence (such as, for example, the New York Times observation that, "If innovation has a heart, it's probably a semiconductor, beating to the pace of Moore's Law") to find that the level of ordinary skill in Class 257 arts includes extraordinary creativity and is unprecedented in the history of Man. Applicants have supplied no evidence to the contrary. Applicants' arguments to the contrary are based on Applicants' misunderstanding of the proper legal method (as laid out in the *Examination Guidelines*, 72 F.R. at 57528) for determining the level of skill in a given art.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas L. Dickey whose telephone number is 571-272-1913. The examiner can normally be reached on Monday-Thursday 8-6.

If attempts to reach the examiner by telephone are unsuccessful, please contact the examiner's supervisor, Sue A. Purvis, at 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Thomas L. Dickey/
Primary Examiner
Art Unit 2826